

PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Process for the Manufacture of Pulverized Iron

We, HOKURIKU KAKO KABUSHIKI KAISHA, a corporation of Japan, of 2, 1-chome Honcho-Nihombashi, Chuo-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a process for the manufacture of pulverised iron, and more particularly the manufacture of a high purity pulverised iron by a simple procedure and at low cost, whereby iron or steel is nitrided at an appropriate temperature and then the resulting brittle material is pulverized to a desired grain size, and finally denitrided in a denitrifying gas, such as hydrogen, by heating at a suitable temperature, or by thermal decomposition under avoidance of oxidation.

The object of this invention is to provide a process which is extraordinarily simple and can avoid usual disadvantages and provide a pure iron powder.

Prior methods for the production of pulverised iron include:—

- (1) Pulverization of electrolytic iron;
- (2) Reducing high purity oxidized iron powder and crushing the resulting reduced iron powder;
- (3) Spraying molten iron;
- (4) Reducing and purifying powdered iron ores.

The process of method (1), i.e. a process of pulverizing electrolytic iron, is only applicable to special uses, because electrolytic iron is inherently of a very high price and iron pulverized to a desired grain size from such a high price material as the electrolytic iron is consequently of a still higher price.

In the process of method (2)—a process wherein oxidized high purity iron is sub-

jected to chemical reduction, and the thus reduced iron is pulverized—the pulverized iron powder obtainable is at most 98% Fe, even when high purity oxidized iron is available from high grade or high purity iron ores. Regardless of the purity of the material upon which the process is performed, it has been proved to be impossible to obtain 100% purification. The iron powder according to this process is of a rather considerably high cost, although of course it is of relatively low cost as compared with an electrolytic pulverized iron.

In the process of method (3) wherein molten iron is sprayed, a molten iron with the carbon content controlled, for instance, at 3.2 to 3.4% is ejected through an alumina nozzle with compressed air for converting said molten iron into oxide in powder form, which is chemically reduced in an atmosphere containing C and O at a ratio of 3:2, and the product is pulverised. Thus, the remaining oxygen will amount to around 0.7% and the purity will be about 98%. Such procedures are intricate and high cost results.

In the process of method (4), for reducing fine ores which is accompanied by purification the raw materials may be low priced, but a complex procedure is required in such cases. Accordingly the product obtained becomes high priced and the purity of the product is about 98% at most, 0.7 to 0.8% of oxygen remain at least.

The invention consists in a process for manufacturing pulverised iron of high purity, said process comprising nitriding thin steel scrap at elevated temperatures in the presence of ammonia gas, pulverising the nitrided steel to a desired particle size, and denitrifying the pulverised product.

The invention also consists in a process for manufacturing pulverised iron of high

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5 purity, said process comprising charging steel plate scrap of 0.5 mm. thickness in layers into a furnace, maintaining the layers of scrap at a temperature of 750° C. in the furnace for one hour, while passing ammonia gas therethrough to nitride the scrap, cooling the nitrided product, crushing the cooled product to pulverise it, screening the crushed product to obtain a powder, charging the nitrided powder which has passed through the screen into the furnace again, and maintaining the powder at a temperature above 700° C. in the absence of oxygen to denitride it.

15 The denitriding step may be carried out at a temperature of 800° C. in the absence of oxygen by passing a denitriding gas through the nitrided product, and such denitriding gas may be the waste gas from the nitriding step.

20 EXAMPLES.

1. 500 gm thin steel plate scrap of 0.5 mm. thickness, were placed in layers and charged in a 4KWH muffle furnace and treated at 750° C. for one hour while ammonia gas was passed therethrough, cooled and crushed, and sieved to 100 mesh. The resulting powder was charged again into the 4KWH muffle furnace and treated for 0.5 hour at 800° C. With the waste gas from the nitriding referred to above passed therethrough, the treatment was effected, which resulted in a production of 485 gm iron powder (-100 mesh) of 99.5% Fe.

2. 500 gm. mild steel scrap were charged into a 4 KWH muffle furnace and treated at 700° C. for one hour with ammonia gas being passed therethrough, crushed after cooling, and sieved to -100 mesh.

40 Again, the above powders were charged into the 4 KWH muffle furnace and treated at 800° C. for 0.5 hour with the waste gas from the nitriding referred to above being passed therethrough, and 490 gm iron powder of 99.2% Fe (-100 mesh) were obtained.

45 WHAT WE CLAIM IS:—

1. A process for manufacturing pulverised iron of high purity, said process comprising nitriding thin steel scrap at elevated tem-

peratures in the presence of ammonia gas, pulverising the nitrided steel to a desired particle size, and denitriding the pulverised product.

2. A process for manufacturing pulverised iron of high purity, said process comprising charging steel plate scrap of 0.5 mm. thickness in layers into a furnace, maintaining the layers of scrap at a temperature of 750° C. in the furnace for one hour, while passing ammonia gas therethrough to nitride the scrap, cooling the nitrided product, crushing the cooled product to pulverise it, screening the crushed product to obtain a powder, charging the nitrided powder which has passed through the screen into the furnace again, and maintaining the powder at a temperature above 700° C. in the absence of oxygen to denitride it.

3. A process for manufacturing pulverised iron of high purity, said process comprising charging steel plate scrap of 0.5 mm. thickness in layers into a furnace, maintaining the layers of scrap at a temperature of 750° C. in the furnace for one hour, while passing ammonia gas therethrough to nitride the scrap, cooling the nitrided product, crushing the cooled product to pulverise it, screening the crushed product with a 100-mesh screen, charging the nitrided powder which has passed through the screen into the furnace again, maintaining the nitrided powder at a temperature of 800° C. in the furnace for one half hour in the absence of oxygen, and passing denitriding gas through the furnace to denitride the powder therein.

4. A process according to Claim 2 or 3 wherein the waste gas from the nitriding step is used to denitride the nitrided powder in the furnace.

5. The process for manufacturing pulverised iron of high purity substantially as hereinbefore described and claimed.

6. Pulverised iron of high purity obtained by the process hereinbefore described and claimed.

7. Pulverised iron of high purity obtained in accordance with the foregoing Examples 1 and 2.

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